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AUTHORS' ABSTRACTS.

Origin of the Iowa Lead and Zinc Deposits. By A. G. LEONARD. Am. Geol., Vol. XVI., November 1895.

The deposits occur in the northeastern corner of the state and form part of a larger area embracing the southwest portion of Wisconsin and northwest corner of Illinois. The ore occurs in crevices in the Galena and Trenton limestones, and in Iowa most of it has been taken from the upper fifty feet of the Galena beds.

The minerals were originally deposited as sulphides along with the sediments in certain areas where, borne by currents, they first came in contact with abundant organic life. There is no evidence of general diffusion and subsequent concentration by surface decomposition of rocks as apparently the case in Missouri.

At a later period the Galena beds were raised into folds and east and west fissures formed which becoming channels for underground waters were enlarged into cave-like "openings." In the latter the ores mostly occur.

There is nothing to show that the deposits were formed by hot solutions rising through fissures from great depths. On the other hand there is abundant evidence to prove that to the process of lateral secretion is due the deposition of the ores in the crevices and that they have thus been derived from the limestone whence they have been leached by surface waters. There is reason to believe that the Galena limestone contains lead and zinc diffused through it in small quantities. This theory does not necessitate the derivation of the minerals from the rocks immediately adjacent, but they may have been leached for a considerable distance on either side. Thus the metalliferous contents of the country rock would be sufficient to supply the deposits.

The Gold-Silver Veins of Ophir, California. By W. LINDGREN. Fourteenth Ann. Report of the U. S. Geol. Survey, pp. 243–284.

The deposits described are located in the gold belt of the Sierra Nevada near the contact of a *massif* of granodiorite of late Mesozoic age with older post-Carboniferous, probably also Mesozoic, amphibolite schists. The latter are in places impregnated with slightly auriferous iron pyrites, forming belts or *fahlbands.* The deposits are typical fissure veins forming two systems, one with a west-northwest strike, the other with a northeast strike; all fissures dip southeast or southwest at angles ranging from 20° to 80°. The vein filling is principally quartz, with very little calcite. Native argentiferous gold, with small quantities of auriferous and argentiferous sulphides comprise the ores. The richest ore is usually concentrated in chutes, mostly of elongated form and dipping east on the plane of the vein. In the amphibolite a distinct connection may frequently be noted between the *fahlbands* and the pay chutes on the veins crossing them. Next to the veins the country rock is altered by replacement to a mixture of carbonates, sericite and iron pyrites. This process, to which nearly all deposits of the gold belt are subject, is illustrated by several analyses.

The fissure systems have in all probability been formed simultaneously by a compressive stress acting in a direction parallel to the trend of the Sierra, and the fissuring was attended with considerable horizontal motion. Hot siliceous and carbonated solutions containing heavy metals dissolved in alkaline sulphides ascended the veins, altering the wall rock and depositing the silica and ores in the largely open fissures. Action of percolating surface waters seems out of the question. The auriferous iron pyrites of the *fahlbands* were probably a source of local enriching of the veins, but the derivation of the largest part of the precious metals must as yet be considered an open question. A map of the vein systems accompanies the paper.

Ueber das Norian oder Oberlaurentian von Canada. By FRANK D. ADAMS. *Neues Jahrbuch für Min, etc.*, Beil. Bd. VIII., 1893.

The author having in a former paper shown that the great anorthosite masses supposed by the earlier Canadian geologists to form the upper portion of the Laurentian system, are in reality great igneous intrusions, proceeds in the present article to give an account of a large area of the typical Laurentian to the north of Montreal, in which he deals principally with the petrological character, stratigraphical relation and origin of the Grenville series, which is the true upper portion of the Laurentian. The lower or fundamental gneiss in its uniform character, as well as in its mineralogical and chemical composition, has the character of an igneous rock. The Grenville series, which appears to rest upon it, frequently has a well-banded character with rapid alternations of various varieties of gneiss, which are in many places interstratified with heavy bands of crystalline limestone, quartzite, etc., has the character of a sedimentary series. A set of analyses of the gneisses, some from the Fundamental gneiss and some from the Grenville series are given, and it is shown that the former have the composition of granite, while the latter have that of sand and clay, a composition quite different from that of any igneous rock, but like that of ordinary sediments. It is also shown that these rocks do not always occur highly inclined, but that over great areas they lie nearly flat or in low undulations, suggestive of thin crust buoyed up by some semi-fluid or plastic material beneath, probably a great batholite granite mass, a portion of which is exposed in one part of the area. The effect of pressure acting after the intrusion of the anorthosites through the Grenville series, is shown in the development of a foliation in the peripheral portion of all the great igneous intrusions, and in the movements which have caused the foliation of the gneiss to follow, and to a certain extent the outline of these more resistant masses. The Grenville series, therefore, comprises certain primeval sediments which have been deeply buried, invaded by great masses of igneous rocks and recrystallized. A map of the area and a photograph of a cliff of the horizontally banded gneiss accompany the paper.

Relations of the Granite and Porphyry Areas in Southeastern Missouri.

By CHARLES R. KEYES. Geol. Soc. of Am., Philadelphia, 1895.

As is well known the granitic rocks of Missouri are the only massive crystallines occurring in the Mississippi basin between central Arkansas and Lake Superior and between the Appalachians and the Rocky Mountains. They are, moreover, the most ancient rocks exposed within the limits of the region. As irregular, discontinuous fields they are scattered over a district of about 3000 square miles.

Lithologically the crystalline rocks comprise both acid and basic varieties. The latter, however, are unimportant and occur usually as narrow dikes; the former comprise two well-marked structural phases, one a coarse-grained granite and the other a porphyry. Mineralogically and chemically the two kinds are practically identical. It is quite manifest that the two phases gradually merge into each other, and the porphyry is to be regarded as the surface facies of the coarse-grained rock.

Heretofore no explanation has been advanced regarding the peculiarities in the geographic distribution of the granitic and porphyritic masses. It is the purpose of the present note to ascribe the surface distribution, as now existing, to certain stages in the physiographic development of the region. In its main features the crystalline district of Missouri is a semi-alpine country. The prominent solitary peaks are irregularly distributed, and form what has been called the St. Francois Mountains. This group of hills constitutes the eastern end of the crest of the Ozark uplift. The extremes of altitude are about 500 and 1800 feet above tide level.

Most prominent among the physiographic features presented are two plains standing at different levels. The first is a deeply incised constructional surface — the Tertiary peneplain; and the second is a moderately dissected plain lying at a lower level — the Farmington lowland. The great Tertiary peneplain forms the general surface of the Ozark uplift. In no part of this raised region, unless it be in the St. Francois district, does any portion of the pre-Tertiary surface project above the broad constructional plain, and even here the nearly uniform height to which the numberless peaks rise would indicate that they also were practically obliterated in Tertiary times, at least as prominent surface features. The Farmington lowland is formed by a broad belt of rather even surface which cuts across the eastern end of the crest. Its general elevation is about 1000 feet above mean tide, a level which is 700 to 800 feet below the horizon of the great peneplain. The lowland is manifestly a plain of denudation. It is the product of a former cycle whose work was interrupted before completion. In point of time this cycle was a later one than that represented by the Tertiary peneplain, and immediately preceded the present one.

In the areal distribution the principal granite field is confined to the northeastern part of the crystalline district and occupies about one-fifth of the entire area. The particular fact to be noted regarding it is that it lies entirely within the lowland plain of denudation. The inference is clear that at this point in the Ozark uplift the porphyritic surface facies of the granite has been removed through erosion in part perhaps in pre-Cambrian times but largely during a more recent period.

The fact that the general surface facies of the acid rock has been actually eroded is shown by several high isolated hills which rise out of the granite area. Some of these, as Knob Lick for instance, are still capped by porphyry. They show further that the granite, to a depth of over 400 feet has been removed in addition to the surface shell of porphyry.

To recapitulate:

1. The granites and porphyries are very closely related genetically, and are to be considered as facies of the same acid magma.
2. Whatever may have been their origin, whether from a few or many points of extravasation, the present relations of the two are that the porphyry is an upper and surface facies of the granite, the thickness of the former being variable, having been originally unequally developed in different places and subsequently modified both ancient and recent erosion.
3. The present geographic distribution of the granites and porphyries is the outcome of very recent changes in the topographic configuration and not of very ancient origin as it has been usually regarded.
4. The existing areal relations of the principal masses of the acid rocks may be traced directly to the systematic and wide-spread physiographic effects arising from recent orogenic action.
5. An element of uncertainty regarding the geological age of the massive crystalline rocks now prevails and an exact determination may always remain a problem yet to be solved.
6. The basal complex of Archæan schists exists in the state within a very moderate distance beneath the highest Palæozoics. It differs widely in lithological characters from the crystallines usually referred to that age, but closely approaches the more typical Archæan rocks of other districts.

Syenite-Gneiss (Leopard Rock) from the Apatite Region of Ottawa County, Canada. By C. H. GORDON. Bull. Geol. Soc. Am., Vol. VII., pp. 95–134. Rochester, December 1895.[1]

In the collections of the Canadian Geological Survey at the World's Fair there were displayed specimens of a rock showing a peculiar lumpy aggregation of the feldspathic constituents. During the summer of 1894 the author visited the region from which this rock was obtained and studied its relations in the field, subsequently studying in the laboratory the material obtained.

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[1] Thesis presented for degree of Doctor of Philosophy, University of Chicago, June 1895.

The rock was found to occur at High Rock, an apatite mine on the west bank of the Du Lievre River about twenty miles above Buckingham, in a series of dikes intersecting quartzites, and pyroxenites. In general the rock has the composition of a syenite though in places carrying more or less quartz, and is often associated with the apatite deposits, but no attempt is here made to show their genetic relationship.

The dike rock in its various phases shows more or less evidence of dynamic action, and the term syenite-gneiss is applied to it. It presents three distinct phases which the author designates as *coarse-grained syenite-gneiss, ellipsoidal syenite-gneiss and streaked syenite-gneiss.* The first consists of a coarse-grained mixture of microcline and monoclinic pyroxene with a small but variable amount of quartz. The rock is divided into irregular blocks by obscure seams which apparently represent recemented cracks. In the second phase it consists of irregularly ellipsoidal or ovoid masses of feldspar and some quartz separated by narrow anastomosing partitions of green interstitial material, chiefly augite. Frequently the crystals of pyroxene, which are elongated in the direction of the prism, lie transverse to the interstitial layer and thus present a more or less pronounced radiate appearance. From the rounded ellipsoidal forms the feldspathic lumps vary to more and more flattened forms until the structure merges into the third phase, in which the pyroxene layers are arranged in parallel bands alternating with somewhat thicker feldspathic layers. Here there is marked diminution in the size of the grains, while quartz becomes relatively more abundant. Large crystals of apatite appear in places inclosed in the ellipsoidal rock, and having the ellipsoids arranged concentrically about them. Masses of apatite also occur in the streaked rock, crushed to a more or less granular, saccharoidal condition, and around them the streaks of pyroxene curve concentrically.

Under the microscope the coarse-grained rock is found to be composed chiefly of microcline, with a much smaller proportion of augite and a variable but usually small amount of quartz. The rock is intersected in various directions by fine, granular bands, made up of microcline and plagioclase, the latter usually containing small nodular quartz inclusions. The grains of augite sometimes show the effects of mechanical movements in the fracturing of grains which lie in contact with the granular bands.

In the ellipsoidal rock the granular bands are more pronounced and strongly marked by the presence of pyroxene. Quartz appears in greater amount than in the coarsed-grained rock. In the streaked gneiss all the constituents are finer grained. Hornblende appears here frequently, sometimes in sharply idiomorphic crystals. Both in their field relation and in their microscopical structure these rocks show a gradation from the coarsely crystallized rock to the fine-grained streaked gneiss.

In the classification of gneisses it is suggested that the term gneiss be used in the broader structural sense following the prevailing usage among Canadian geologists; where the origin of the rock is known a corresponding qualifying term may be used as diorite-gneiss. Where the origin is unknown, the ending "ic" may be given to the qualifying term to show its structural relations, as dioritic-gneiss. In harmony with this view the rock under consideration would be a pyroxene-syenite-gneiss. As to the origin of the ellipsoidal structure the evidence, while in many respects incomplete, involving as it does much that is as yet little understood in the metamorphism of rocks, seems on the whole to favor the hypothesis of dynamic metamorphism.

Briefly summarized this supposes:

1. That the structure characterizing the Leopard rock is due to orographic agencies and represents an intermediate stage in the development of a streaked augite-syenite-gneiss out of an augite-syenite, which was distinguished by a coarsely crystallized structure and by a somewhat irregular aggregation of pyroxene.

2. That the distribution of the pyroxene has been effected by the solution of portions of the original constituents and their recrystallization along lines marking the location of the cracks.

3. That with continued pressure these lumps have been more and more drawn out, the process being accompanied by recrystallization until the rock assumed the streaked gneissoid form.

RECENT PUBLICATIONS.

—ADAMS, FRANK D. and B. J. HARRINGTON, On a New Alkali Hornblende and a Titaniferous Andradite from the Nepheline Syenite of Dungannon, Hastings Co., Ontario, 9 pp.—Am. Jour. of Science, Vol. I, 1896.